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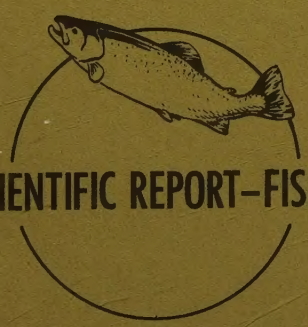
PROGRESS REPORT ON ALASKA FISHERY MANAGEMENT AND RESEARCH 1958



SPECIAL SCIENTIFIC REPORT–FISHERIES No. 294

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

EXPLANATORY NOTE

The series embodies results of investigations, usually of restricted scope, intended to aid or direct management or utilization practices and as guides for administrative or legislative action. It is issued in limited quantities for official use of Federal, State, or cooperating agencies and in processed form for economy and to avoid delay in publication.

United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner

PROGRESS REPORT ON

ALASKA FISHERY MANAGEMENT AND RESEARCH, 1958

Prepared by
The Staff of the Alaska Region
Bureau of Commercial Fisheries

United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 294

Washington, D. C.
June 1959

The Library of Congress catalogue card for this publication:

U. S. *Bureau of Commercial Fisheries.*

Progress report on Alaska fishery management and research, 1957–1958, prepared by the staff of the Alaska Region, Bureau of Commercial Fisheries. Washington, U. S. Dept. of the Interior, Fish and Wildlife Service, 1958–59.

2 v. illus., maps, diagrs., tables. 27 cm. (U. S. Fish and Wildlife Service. Special scientific report—fisheries, no. 258, 294)

Title varies slightly.

1. Fisheries—Alaska. 2. Salmon-fisheries—Alaska. 3. Fisheries—Research. I. Title: Alaska fishery management and research. (Series: U. S. Fish and Wildlife Service. Special scientific report: fisheries, no. 258 [etc.])

[SH11.A335 no. 258, etc.] Int 59–119

U. S. Dept. of the Interior. Library
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The Fish and Wildlife Service series, Special Scientific Report--Fisheries, is catalogued as follows:

U. S. *Fish and Wildlife Service.*

Special scientific report: fisheries. no. 1–
[Washington] 1949–

no. illus., maps, diagrs. 27 cm.

Supersedes in part the Service's Special scientific report.

1. Fisheries—Research.

SH11.A335 639.2072 59–60217

Library of Congress [2]

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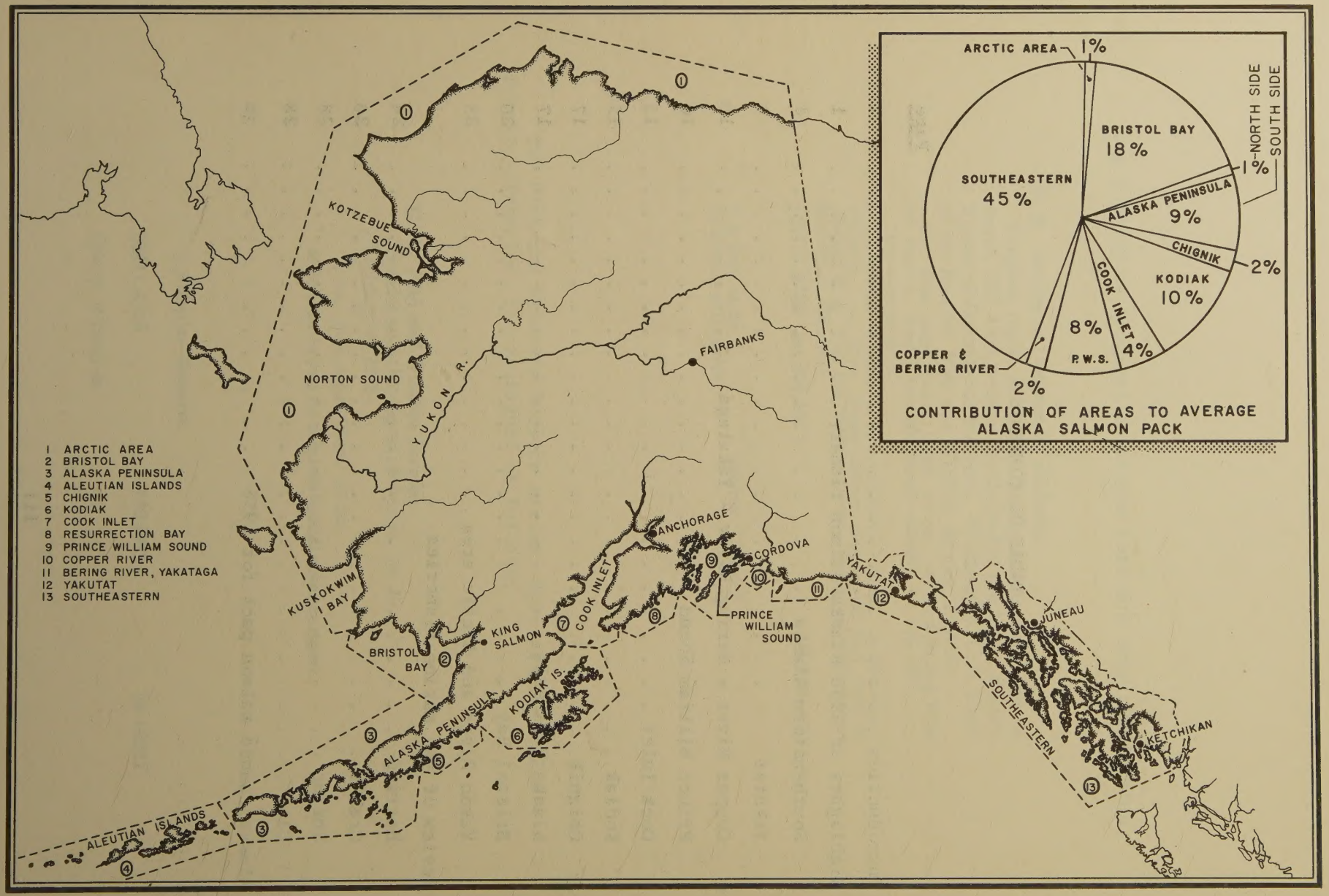

Major regulatory districts in Alaska

SSR-F 294 (Progress report on Alaska fisheries)

PROGRESS REPORT ON

ALASKA FISHERY MANAGEMENT AND RESEARCH, 1958

INTRODUCTION

The management of Alaska's commercial fishery resources has long been the responsibility of the Federal Government. The objectives, of course, are the promulgation and execution of measures to achieve maximum sustained production of fishery products. To accomplish this, it is necessary to maintain the presently fished populations at maximum levels and to bring into production species not now being utilized. These are problems assigned to the Bureau of Commercial Fisheries of the U. S. Fish and Wildlife Service.

One of the stumbling blocks today in achieving management objectives is the lack of knowledge of the fish themselves. What factors affect their reproduction and growth, where and when do they migrate, to how much natural and fishing mortality are they subjected, and how large a spawning stock is necessary to give maximum production? These factors vary from species to species and, within the species, from area to area. Therefore, considering the size of Alaska, its varied climate and geography, it is apparent that a great amount of basic information concerning the fish themselves must be obtained if proper management methods are to be developed.

The Bureau's intensified biological research efforts in Alaska during the past several years are beginning to shed some light on the problems. Knowledge gained from these efforts is utilized as rapidly as it becomes available in promulgating fishing regulations.

The history of the development of the continental United States and other countries demonstrates that such development results in demands on water resources that may be inimical to fisheries. Pollution, construction of dams, and diversion of water from streams can render waters unfit for production of fish. Some of these problems have already arisen in Alaska, and it is safe to assume that they will increase rapidly. With proper planning and understanding, serious damage to the fishery resources can be avoided.

There are in Alaska many commercially abundant species of fish that are not now being utilized. Through its technological, exploratory fishing, and market development branches, the Bureau is assisting in the development of fisheries on some of these species. As the world demand for protein food and the need for additional resource use to support Alaska's basic economy increase, full development of all of Alaska's potential fisheries will be required.

With the advent of statehood for Alaska, certain commercial fishery management functions that are now the responsibility of the Federal Government will be assumed by the new State. These will be chiefly the development and enforcement of fishing regulations. It is imperative to the conservation of Alaska's fishery resources that this transition be made in an orderly, well-planned manner so that continuity can be maintained in the management of the fisheries. To this end, the Bureau of Commercial Fisheries is cooperating fully with the present Territorial Department of Fish and Game by supplying data concerning its management division and practices and background information on the species in the various management districts.

HIGHLIGHTS OF 1958
ALASKA SALMON FISHERY

A pink salmon pack of more than a million and a half cases brought the total

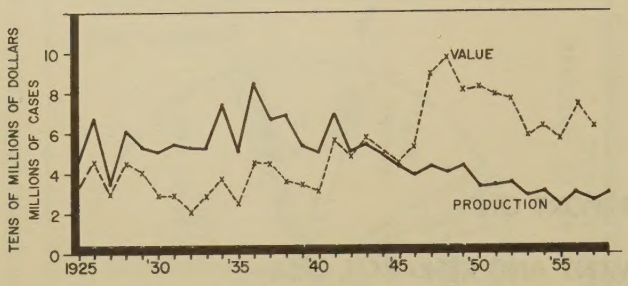

Figure 1.--Production and value of canned Alaska salmon.

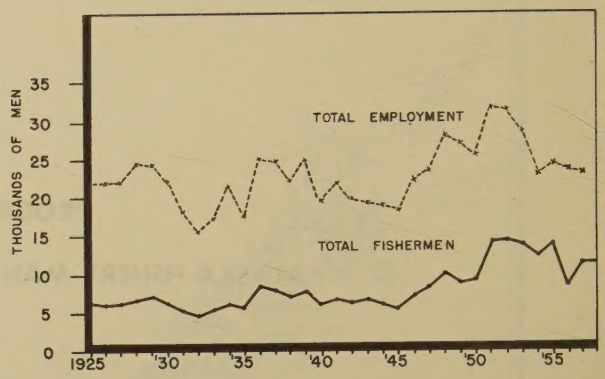

Figure 2.--Employment in the Alaska salmon fishery.

Alaska canned salmon pack for 1958 up to almost three million cases (figure 1)--20 percent over the 1957 production. The number of fishermen employed remained at substantially the same level in 1958 as in 1957 (figure 2 and table 1). Areawise the waters of Southeastern Alaska, particularly those at the south end of Stephens Passage and east and west of Ketchikan, produced the greatest volume of pink salmon. The pack in this area of more than 700,000 cases was the best since 1951. Prince William Sound had an oustanding pink salmon fishery this year, producing 300,000 cases for its best record in ten years. Runs into the Susitna, Nushagak, and Unalakleet Rivers were unprecedentedly heavy, and a late pink salmon run appeared at Unalaska for the first time since 1954 and added much to the production of canneries in the South Peninsula region. In general, the pink salmon runs tended to appear in volume relatively early in the respective seasons and to decline sharply by the time the late runs should normally have appeared. Information is not at hand that would indicate whether or not this was the result of recent general increases in ocean temperature.

Unlike pink salmon, red salmon, which normally make up one-third of the pack, were low in production in all areas and comprised only 16 percent of the total pack. This decrease can be accounted for principally in the Bristol Bay area where the catch was a little more than half that of last year, and in Cook Inlet where the pack of 44,000 cases was one-third of the average for the past several years.

The chum salmon pack was only slightly below the average for the past six years. Chum salmon were well above their average size, a characteristic that prevailed in all five species of salmon this year.

An unexpected development in the king salmon fishery was the mild-curing of some 10,000 of this species at Port Moller prior to the opening of the red salmon season. In addition, the June king salmon fishery on the Nushagak was very successful. In late July and early August a fleet of trollers discovered good fishing for both large king and coho salmon near Middleton Island. This extends the present westward limit of the offshore commercial trolling area.

Floating canneries and freezers all but disappeared from the scene in 1958, their interests being frequently consolidated with shore plants. Tenders with chilled brine tanks are playing an expanding role in the industry, owing to their ability to hold small quantities of fish over long periods of time so that full loads can be made up.

The overall outlook for 1959 is for a smaller pack. The Alaska-wide weakness of the odd-year pink salmon runs will probably be reflected in the cyclic return, and Bristol Bay red salmon are not expected in volume greater than the season just experienced.

Southeastern Alaska

The Southeastern Alaska fishing area embraces all territorial waters of the Alaska Panhandle between Cape Fairweather and Dixon Entrance. Four types of commercial gear--trolls, gill nets, seines, and traps--harvest the five species of Pacific salmon that populate this area. Seines and

Table 1.--Fishermen and fishing gear registered in Alaska, 1958

[b/w = boats with, p = pots, t = trawlers]

District	Registered fishermen			Registered units of gear											
	Resident	Nonresident	Total	Traps	Trolls	Drift nets	Set nets	Beach seines	Purse seines	Herring seines	Shrimp vessels	Clam shovels	Dungeness crab	King crab	Sport commercial
Southeastern	4,150	1,549	1/ 5,699	146	2/ 1,349	King 248 Red 404 Coho 420	King 17 Red 26 Coho 26	17	493	12	14 t		6 b/w 1,177 p		698
Yakutat	146	25	171				King 53 Red 167 Coho 171								
Prince William Sound and Copper River	424	138	562	13	13	King 41 Red 575 Coho 501	Coho 9		192	4		3/ 348	18 b/w 1,502 p		1
Cook Inlet	994	148	1,142	50		King 213 Red 346 Coho 198	King 453 Red 467 Coho 326	112			6 b/w 100 p 4 t	7	89 b/w 1,287 p		
Kodiak	745	505	1,250	22			King 1 Red 87 Coho 8	39	339	5		71		47 b/w 1,139 p 4 t	
Peninsula and Chignik	416	321	737	12		King 67 Red 100 Coho 64	King 18 Red 88 Coho 20	82	169					5 b/w 305 p	
Bristol Bay	936	760	1,696			King 412 Red 1,056 Coho 506	King 31 Red 248 Coho 157								
Yukon	245		245				King 207								
TOTAL	8,056	3,446	11,502	243	1,362	King 981 Red 2,481 Coho 1,689	King 780 Red 1,083 Coho 717	250	1,193	21	6 b/w 100 p 18 t	426	113 b/w 2,766 p	52 b/w 1,444 p 9 t	699

1/ Includes 999 resident trollers, 253 nonresident trollers, 670 resident sport-commercial fishermen, and 24 nonresident sport-commercial fishermen.

2/ Includes 97 incidental trollers who primarily fished net.

3/ Actual registration; a strike prevented full-scale operations.

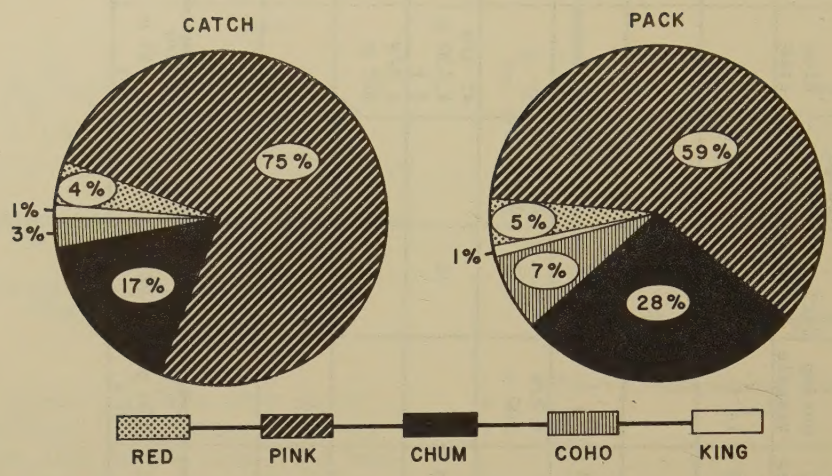

Figure 3.--Southeastern Alaska long-term average catch and pack composition.

traps are usually fished from late June to the end of August and gill nets from early May through September. Trolling takes place in outside waters from mid-April to the end of October. Inside waters, with the exception of specific local areas, may be trolled throughout the year, except for a closed period for coho salmon fishing from late September through June. Pink salmon is the dominant species; chum, red (sockeye), coho, and king salmon occur in decreasing abundance in the order named. The long-term averages of the various species that contribute to the Southeastern Alaska pack and catch are shown in figure 3. The relationship between the catch in fish and the resulting pack in cases is graphically illustrated in figure 3. Seventy-five percent of the total catch of pink salmon contributes only 59 percent of the total pack whereas only 17 percent of the catch of chum salmon accounts for 28 percent of the pack. This, of course, is a result of the fact that chum salmon are a larger species than pink.

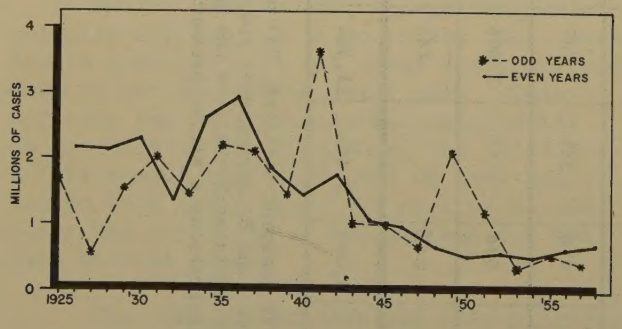

Figure 4.--Pink salmon pack, Southeastern Alaska.

The 1958 pink salmon pack of 703,000 cases (figure 4) compared favorably with the average for the past decade of 750,000 cases and was the best pack since 1951. Twenty-one plants operated this year, some of which represented consolidations of two or more companies. About one-half of the pink salmon pack came from the Ketchikan area, of which the Southern District and the southeastern section of Clarence Strait were the most productive. The escapement was also good. The geopraphic locations of the districts are shown on the map (figure 5). In Icy Strait, Tenakee Inlet, Peril Strait, Eastern District, Sumner Strait, and Clarence Strait (northern section), escapements were below the parent year. The escapements for specific index streams in each of the Southeastern Alaska Districts are shown in figure 6 (page 6).

To better utilize the Lake Bay red salmon run, the southern limit of that gill net fishery was extended this year to Luck Point. Forty thousand red salmon were taken in the combined Red Bay-Salmon Bay-Lake Bay fishery as compared with 3,000 in

REGULATORY DISTRICTS
SOUTHEASTERN ALASKA

Figure 5.--Geographical regions of Southeastern Alaska referred to in text.

in 1957. The total for all species was approximately 58,000, including 12,000 pink, 4,000 chum, 1,800 coho, and 230 king salmon. A satisfactory escapement occurred in Lake Bay.

The Portland Canal gill net fishery produced about 125,000 salmon, of which 85,000 were chum, 30,000 pink, 5,000 red, 4,000 coho, and 240 king. All of the Alaskan tributaries to Portland Canal had satisfactory escapements.

The Lynn Canal gill net fishery was active throughout the season (June 23 to October 10). The red salmon catch of 90,000 fish was equal to the average of the past ten years, while the chum salmon catch, except for the unusual take in 1957, exceeded that of any recent season. Escapement of both species was satisfactory.

The Taku River production of approximately 20,000 red salmon was the lowest since 1946. A catch of about 15,000 king salmon was the best since 1954, and the coho and chum catches were about equal to those of last year which were considered average. The pink salmon catch of 65,000 was the largest since 1951 when 75,000 fish were taken. The king salmon combined escapement of 16,000 into both the Inklin and Nakina Rivers [1/], tributaries of the Taku, was the best since 1951. Escapement of pink salmon, while not believed to be equal to 1951, was considered good. Coho and chum escapements were fair, and red salmon escapement was poor.

Snettisham catch and escapement were short in all species this year.

The Stikine catch of 25,000 red, 10,000 king, 50,000 coho, 30,000 chum, and 19,000 pink salmon is in excess of any of the last four years, except for the king salmon production, which was down about 3,000 fish from the average. Escapement of king salmon in the Little Tahltan River [1/], a tributary of the Stikine, appeared to be equal to that of 1956, which was considerably better than 1957. Surveys of red salmon, which were limited to one observation per stream, showed the escapement to be about half that of 1957.

1/ Estimates by Alaska Department of Fish and Game.

For the second year, an extensive enumeration project was conducted in Southeastern Alaska by the Bureau's research staff to determine the production of pink salmon fry in the southern half of the Panhandle. This is one of two methods being evaluated as a means of predicting the abundance of future pink salmon runs.

Ten migrant stations, all located within the inside waters of the southern half of Southeastern Alaska, were operated during the spring of 1958.

Table 2 presents a comparison of the fry migrations in the ten streams sampled the past two seasons. Two major streams,

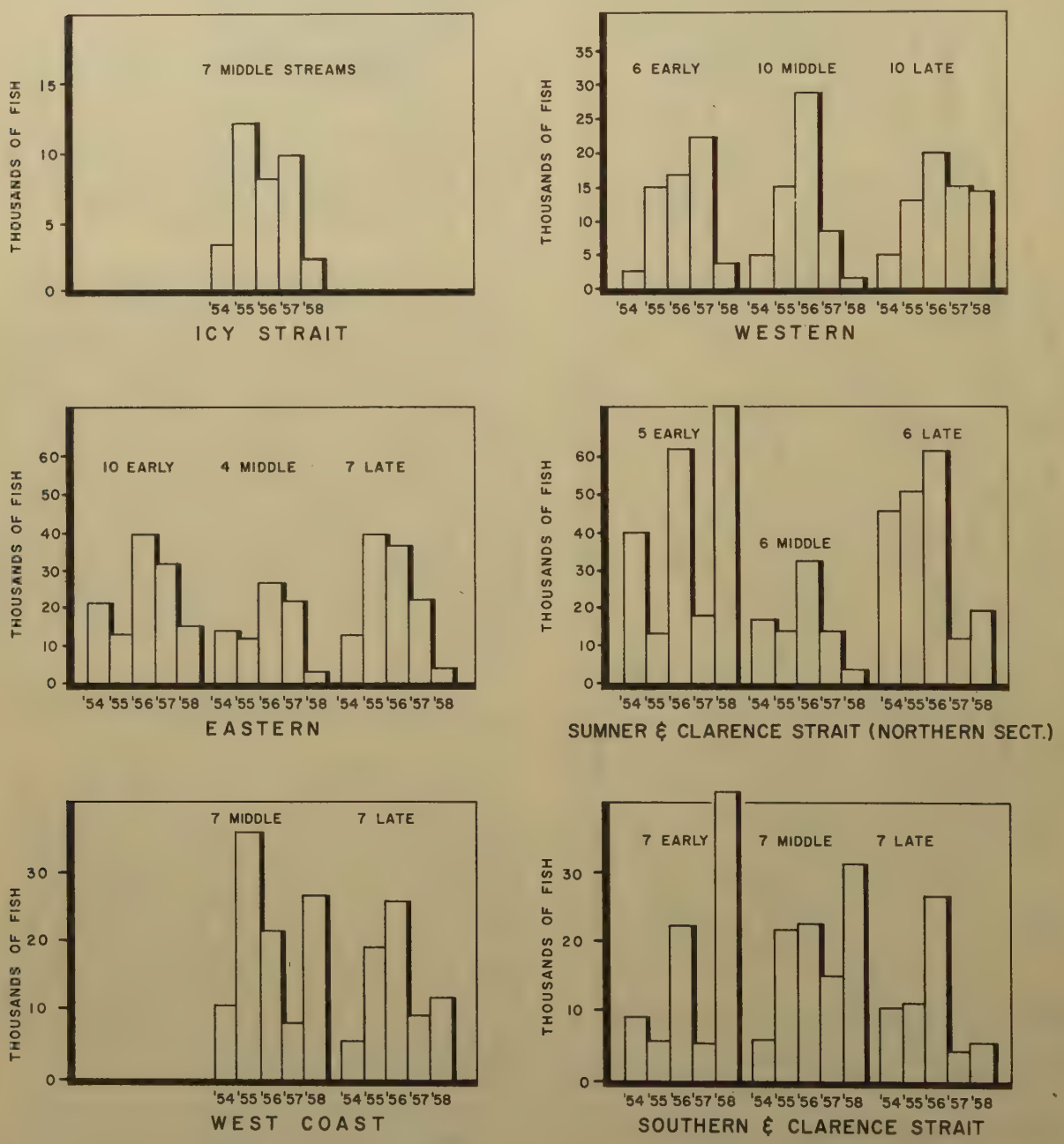

Figure 6.--Pink salmon escapements in early-, middle, and late-run streams, Southeastern Alaska.

Table 2.--Estimates of fry production from Streams sampled in the southern inside waters of Southeastern Alaska for 1957 and 1958.

Stream	Location	Estimated number of migrants (in thousands) 1957		1958	
	Early run				
Anan Creek	Bradfield Canal	26,422		35,357	
Herman Creek	North Behm Canal	5,501		1,537	
Wilson River	Smeaton Bay	7,888		3,998	
	Total		39,811		40,892
	Middle run				
Snake Creek	Zimovia Strait	3,190		1,942	
Totem Bay Creek	Sumner Strait			340	
	Total		3,190		2,282
	Late run				
Bush Mountain Creek	Revillagigedo Channel	259		838	
Dog Salmon Creek	Kasaan Bay	212		17	
Mosman Inlet Creek	North Clarence Strait	920		157	
Naha River	Behm Canal	17,927		20,560	
Old Tom Creek	Kasaan Bay	625		114	
	Total		19,943		21,686
	Grand Total		62,944		1/ 64,520

1/ To make this figure comparable with 1957, Totem Bay production for 1958 has not been included.

Anan Creek and Naha River, produced a greater number of fry in 1958, while another large river, the Wilson, had an outmigration in 1958 about one-half as large as in 1957. Five of the seven smaller streams showed declines this season, and one was much improved. Figure 7 shows a migrant fry station on one of the smaller streams. Comparable data were not available for Totem Bay Creek. Although the overall fry migration appeared to be slightly greater this spring than last, and optimistic prediction for pink salmon adults in 1959 cannot be fully justified in view of the reduced abundance in 1958 of young fish in the majority of the smaller streams, which are generally considered to be the backbone of pink salmon production in this region. Other factors to be considered are the magnitudes of parent escapements and fry survival until seaward migration. Although survival from the spawning of 1957 was somewhat better than that of the previous year, it was not improved sufficiently

Figure 7.--Part of migrant fry station at Snake Creek, showing men taking stream flows.

enough to equal the fry production from the much larger spawning of 1956. Consequently, the total production of fry in this area was somewhat reduced from that of the previous year.

The second method of predicting pink salmon abundance, an annual enumeration of fingerling from commercial salmon traps, was conducted for the fourth consecutive year. Periodic visits were made to the various traps to gather data on fingerling abundance throughout the fishing season. Returns of the numbers of fingerling observed in most areas in Southeastern Alaska are above those of 1957 in all but the Eastern District. However, returns in many areas were below the levels determined in 1955 and 1956. The greatest abundance was observed within Clarence Strait, the lowest within Icy Strait.

In view of the wide divergence this year from the expected adult return, which was based on the low abundance of fingerlings in 1957, the reliability of the trap enumeration method of predicting is questionable. The 1955 and 1956 fingerling abundance indices provided quite accurate predictions of the adult returns of the parent cycles. If this method were truly indicative, the adult returns in 1958 would have produced a salmon pack of fewer than 300,000 cases. The actual pack was slightly more than 700,000 cases. Therefore, a prediction of adult returns for 1959, based on an average of 718 fingerlings per observation, may not be reliable. Yet the number of fingerling salmon was definitely greater than last summer, indicating the possibility of a greater adult return than 1958.

Of the two methods discussed, fry abundance estimation appears at present to be the more reliable means of predicting adult returns of pink salmon, but it has not been thoroughly tested, as only one cycle is available for analysis. The fry production in the sample streams and the apparently lower production in the smaller streams generally indicate an adult return in 1959 similar to, or slightly lower than, 1958. Although the spawning escapement was lower in 1957 than 1956, the stream survival of the young was apparently very favorable. This may compensate for the considerable difference in the escapement of adult salmon in 1956 and 1957 and provide a yield comparable to that of the past summer.

Studies of environmental factors that affect the survival of pink salmon were continued at Little Port Walter. Emphasis was on the measurement of the actual numbers of fry produced by pairs of adults. The technique consists of confining adults in specially designed pens where they are allowed to spawn. The fry are counted after they emerge from the gravel. The survival of the progeny of each pair of adults has been highly variable, ranging from 0 to 40 percent. Natural survival of pink salmon fry in 1957-58, based on counts of fry at the weir, was 22 percent. This is in contrast to 0.3 percent survival in 1956-57.

A major portion of the catalog of Southeastern Alaska salmon streams, which was started last year by the Fisheries Research Institute of the University of Washington, has been completed and will be published in the near future. This report will consist of a summary of the available information concerning the salmon escapements and of maps and physical descriptions of the more than 1,000 salmon streams in Southeastern Alaska.

A large-scale program of tagging pink salmon was conducted off the west coast of Prince of Wales Island in 1957 and again in 1958 by the Fisheries Research Institute under contract to the Bureau of Commercial Fisheries. The pink salmon tagging in the vicinity of Noyes Island in 1957 showed that the early group of fish (July 20 - August 10) was predominantly bound for the Skeena River in British Columbia, while tagging later in the season (August 11 - September 2) revealed migrations principally to Alaskan waters surrounding Prince of Wales Island. The character of the run in 1957 showed a change with regard to the timing of the run, the peak catches occurring about one month earlier than usual. Therefore, comparable tagging experiments were repeated in 1958, when 8,830 pink salmon were tagged from the purse seine fishery and from traps in the Noyes Island area. After stream surveys to recover tags are complete, detailed analysis of the recovery data for both years will begin.

The cooperative research program of the Bureau of Commercial Fisheries, the Fisheries Research Institute, and the U. S. Forest Service on the effects of logging on salmon streams was continued in 1958 at the Forest Service Research Center near Hollis,

Alaska. The general objective of this study is to relate survival of salmon eggs and fry to changes in the stream environment that may be caused by logging operations. The broad plan on which this work is proceeding is to observe conditions in the streams before and after logging. Biologists from the Fisheries Research Institute have devised experimental techniques for measuring subsurface flows, water temperatures, siltation, and oxygen levels in the gravel during the time that the fry are developing, and in 1958 this information was systematically recorded for the study streams. Through the use of tower-counting techniques similar to those previously developed at Bristol Bay data were obtained on pink salmon spawning. Since pink salmon move up the streams chiefly at night, it was necessary to develop a system of underwater lighting for use in the tower counting.

Yakutat

The salmon fishery of the Yakutat district, which extends from Icy Bay to Cape Fairweather, poses management problems not found elsewhere in Alaska. Many of the streams are geologically "young" and have developed fish runs within recent times. Coho salmon was the first species to populate this virgin area and, except for strays of other species, is still dominant in the newer stream systems. The rivers of the area have not yet developed estuaries and empty directly into the Gulf of Alaska. Consequently, although there is some trolling in offshore waters, practically all the commercial fishery is conducted with set gill nets placed in the rivers. In this respect the Yakutat fishery differs from all other salmon fisheries in Alaska. The complexity of the catch composition in this fishery is shown in table 3.

In 1958 the fishing season was interrupted by an earthquake on July 12. Continuing tremors kept fishermen away from the fishing grounds for several days. The effect this had on the total Yakutat salmon run is unknown. The pink and chum salmon catch was 60,000 and 20,000 fish respectively. Both figures are in excess of the averages for the past ten years of 33,000 pink and 13,000 chum salmon. The 45,000 red and 92,000 coho salmon produced in 1958 are about one-half the average for the past ten years. At present the major part of the king salmon run in the Alsek River is protected from the fishery in an attempt to restore this run to its former abundance.

Table 3.--Species composition of Yakutat salmon fishery.

River	Species of salmon					Number of fishermen	Seasons fished - 1958
	Red	King	Pink	Chum	Coho		
Lost River	x		x			10	June 23 - August 10
					x	10	August 10 - Sept. 30
Situk and Ahrnklin Rivers		x				62	June 23 - August 10
	x					62	June 23 - August 30
			x			62	June 23 - Sept. 30
				x	x	62	August 10 - Sept. 30
Dangerous River					x	2	August 10 - Sept. 30
	x					-	Not fished - 1958
Italio River	x		x			4	June 30 - August 10
					x	4	August 10 - Sept. 30
Akwe River	x	x	x			5	June 30 - August 10
				x	x	5	August 10 - Sept.30
Alsek River	x	x	x			29	June 2 - August 10
				x	x	29	August 10 - Sept. 30
East River	x		x			5	June 23 - August 10
				x	x	5	August 10 - Sept. 30
Dohn River			x			2	June 23 - August 10
	x	x				2	June 30 - August 10
				x	x	2	August 10 - Sept. 30

Escapement figures are difficult to obtain in silted rivers, such as Alsek, Akwe, Dangerous, and Yahtse. However, for all species of salmon, except coho and chum, the escapement that was observed was in excess of the commercial catch. The Situk River had a favorable escapement of about 70,000 pink and 40,000 red salmon.

Copper River - Bering River - Yakataga

Except for trolling, which is permitted off Yakataga, gill nets are used exclusively in the estuarine fisheries of the Copper River area, which extends from the western extremity of the river delta to Icy Bay. The Copper and Bering Rivers are the principal producers of salmon in this area, and both are fished for red, king, and coho salmon from early May to mid-September. The Yakataga district has two small coho fisheries, the Tsiu and Kaliakh, which are fished from early August to mid-September.

The total 1958 production of the Copper and Bering Rivers consisted of 28,000 cases of red salmon (figure 8)--9,000 of coho and 2,000 of king--about one-half the average of the past ten years. The Yakataga production of 10,000 coho salmon, most of which were from the Kaliakh River, was slightly below the average for the past six years.

Information obtained pertinent to the substantial subsistence fishery in the Copper River tributaries indicated 30 fish wheels were used by local residents who took 12,000 red and 500 king salmon for their personal use and for dog food. Spawning ground observations made during the season plus aerial surveys indicated a good escapement of red, king, and coho salmon.

Prince William Sound

The Prince William Sound district, which extends from Cape Fairfield to Point Whitshed (including Middleton Island), is characterized by some 200 short spawning streams. These streams have capacities of from a few pair to as high as 60,000 pink salmon, and much of the successful spawning of this species occurs in the intertidal zones. A feature peculiar to this area is that there is little natural estuarine protection, and the salmon are either in the area of the commercial fishery or on the spawning grounds--some times both simultaneously. Average salmon production in Prince William Sound consists of 55 percent pink, 25 percent chum, 13 percent red, 6 percent coho, and 1 percent king. Seines and traps are used to harvest the catch, which takes place from mid-July through early August.

The 1958 pink salmon run in the Sound was the best in the past 11 years (figure 9). The pack of some 300,000 cases was well above the annual average of 172,000 for the past ten operating years and made up over 80 percent of the 1958 total pack, which included all species. An additional million plus pink salmon, or roughly 60,000 cases, were exported from the district. In addition to the good commercial harvest, an excellent escapement occurred. In 1954 and 1955 all commercial fishing for salmon in Prince William Sound was closed, except at Eshamy which is the major red salmon produc-

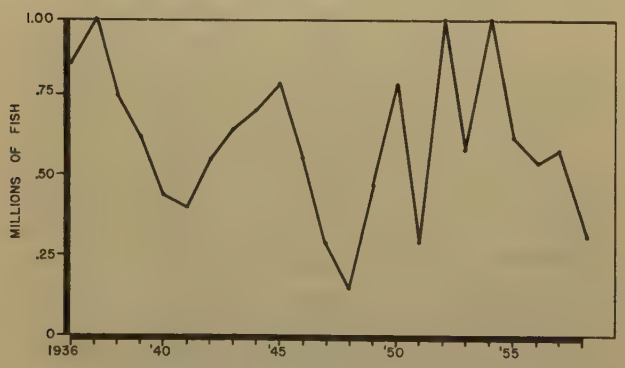

Figure 8.--Red salmon catch, Copper River.

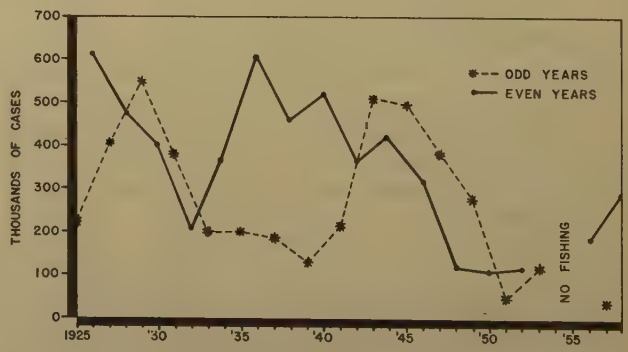

Figure 9.--Pink salmon pack, Prince William Sound.

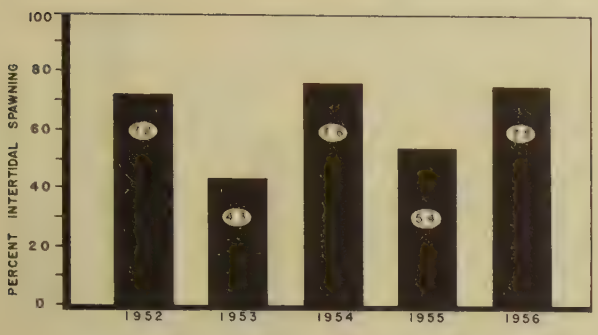

Figure 10.--Intertidal spawning of pink salmon, Prince William Sound.

ing area in the Sound. Owing to a low cycle of abundance in red salmon, the Eshamy district was closed to fishing in 1958. No improvement is expected in this area in 1959.

Significantly, in contrast to the even-year production, the odd-year pink salmon run in Prince William Sound is at a minimal commercial level. In 1957 a total run of less than a million fish was indicated from an estimated escapement of 100,000 and a pack of 35,000 cases. In comparison, the 1958 estimated total run was 7.2 million fish.

A troll fishery developed off Middleton Island for the first time this year. During a 6-week period a fleet of some 30 boats produced 210,000 pounds of salmon, about 45 percent king and 55 percent coho.

Research efforts in the Prince William Sound district were directed toward developing two methods of predicting the magnitude of returning adult runs of pink and chum salmon.

The first method, an enumeration of pink and chum salmon fry, saw continuation and expansion of an extensive fry sampling program that was initiated in 1957. Migrant trapping stations were operated on six streams to determine production of stream areas above the intertidal zone. The intertidal areas of 14 streams were sampled to determine production in this zone. The importance of intertidal spawning to overall production in Prince William Sound is evident from the fact that one-half to three-fourths of all spawning occurs in this zone (figure 10). Intertidal spawners tend to dominate the even year runs.

Intertidal area sampling was accomplished by using a technique developed by the Fisheries Research Institute in which an "egg pump" flushed pink and chum larvae out of the gravel with a mixture of air and water under pressure (figure 11). Fundamentally, the method is that of sampling unit areas and then estimating the total number of living organisms from fractions of the total area sampled. Based on this sampling technique, intertidal production for 131 streams in Prince William Sound was estimated at 9 milion pink and 6 million chum salmon fry.

Sampling in stream areas above the intertidal zone was conducted in a similar manner as in 1957 by fishing an array of traps at the mean high tide line in each of the six streams. The downstream migration this year was far different in character from that of 1957. It was of less magnitude, got underway earlier, and was of shorter duration (figure 12). The 1958 outmigration for the six study streams was estimated at 1.1 million pink salmon fry, compared with 3.5 million for 1957. There

Figure 11.--Collecting samples of eggs and fry with "egg pump".

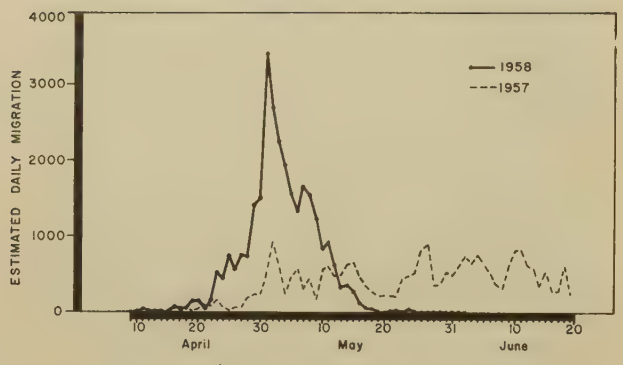

Figure 12.--Downstream migration of pink salmon fry at Fish Bay in 1957 and 1958.

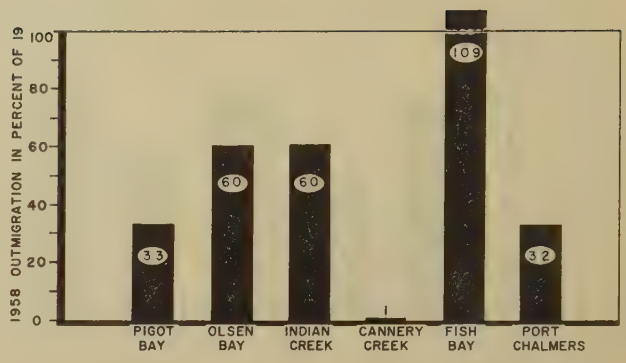

Figure 13.--Comparative magnitude of outmigration of pink salmon fry in six Prince William Sound streams.

was considerable variation in production between streams. The size of the outmigrations by streams in 1958 varied between 1 and 109 percent of that in 1957 (figure 13). Chum fry production in these six streams was estimated at 2.5 million in 1957 and 0.5 million in 1958.

More data are needed before a forecast can be made of adult returns; based on the magnitude of the fry migration. Present evidence indicates the run in 1959 will be much poorer than it was in 1958.

In the second method studied the relationship between the numbers of adult spawners per key stream and the return two years later was used to forecast the 1957 and 1958 returns. On the basis of this correlation, a poor run of pink salmon was predicted for 1957; the return was smaller than expected. For 1958 the expected return was 6 million; the actual return was about 7.2 million. Even though there were some differences between the expected and the actual return, the general magnitudes of the forecasts were substantially correct.

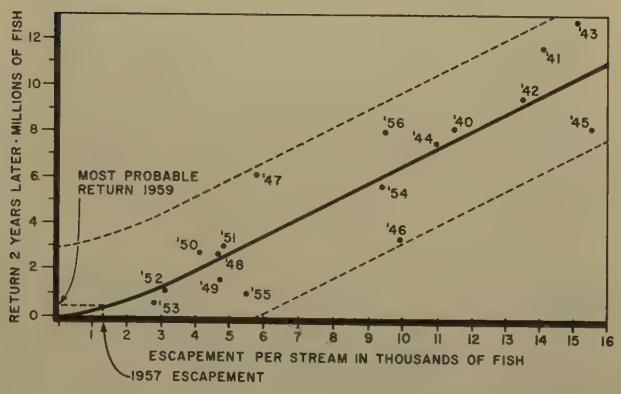

Figure 14.--Relationship of escapement to return, 70 key pink salmon streams, Prince William Sound.

The 1957 escapement was the lowest on record, only 1,325 pink salmon per key stream. At this low level of abundance the trend line is somewhat uncertain because there are few data available. However, the most probable return in 1959 is about 500,000 pink salmon (figure 14). The odds are 2 to 1 that the return will be between 0 and 2.1 million fish. There is about 1 chance in 20 that the run will be greater than 3.7 million. This is the most reliable forecast for 1957 now available.

The Fisheries Research Institute, under contract to the Bureau of Commercial Fisheries, continued its studies of migratory routes and timing of salmon runs in Prince William Sound. Of 3,341 pink salmon tagged in Prince William Sound in 1957, 1,135 were recovered, 23.8 percent coming from the commercial fishery and 10.2 percent from the spawning grounds--a total recovery of 34 percent. In addition, of 576 chum salmon tagged, 135 were recovered. In all of the experiments, regardless of the location of tagging, the wide scattering of recoveries gave evidence of considerable wandering of individual fish in a "to-and-fro" manner.

Cook Inlet

Cook Inlet has several complex salmon fisheries, and problems of their management are complicated by the rapid settlement and industrial development of the area. The population in the area around Anchorage is nearing one-quarter million, and an elaborate network of roads and highways has made fishing and spawning grounds accessible that were nearly isolated a few years ago. As a result, personal-use and sport fishing are now very important factors in the management of the fishery.

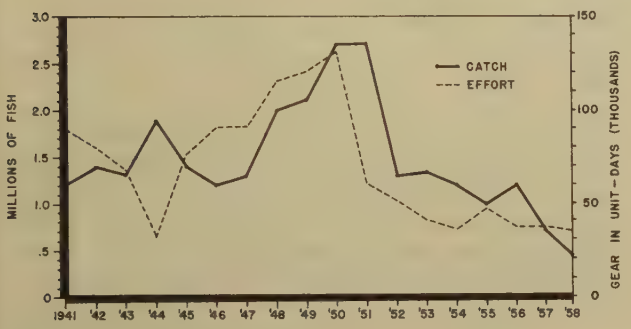

Figure 15.--Catch and fishing effort, Cook Inlet red salmon.

Until ten years ago, a stable set net and trap fishery produced an average pack of 125,000 cases of red salmon in July of each year. Some 20,000 cases of king salmon were put up in June, and beach seiners conducted a minor but dependable fishery for pink and chum salmon around the lower Kenai Peninsula after the red salmon run was over.

A new drift gill net fishery invaded the Inlet in the late 1940's and raised the red salmon pack to 175,000 cases in both 1950 and 1951 (figure 15). Since then the red salmon catch has greatly declined. More recently, the king salmon runs have also dwindled, but a new pink salmon run has developed along the east shore of the upper Inlet in early August of the even-numbered years. Chum salmon occur in variable but often substantial abundance along with the red salmon in July. Coho salmon support a very small fishery the latter part of August. Figure 16 shows the relationship of the average pack of the Cook Inlet salmon fishery to the 1958 pack.

Probably nowhere in Alaska were this season's salmon fisheries more aberrant than in Cook Inlet. The pack consisted of only 6,600 cases of king salmon and 38,000 cases of red salmon. The chum salmon pack was normal. Pink salmon saved the season for fishermen and packers alike with a phenomenal production of 165,000 cases--the result

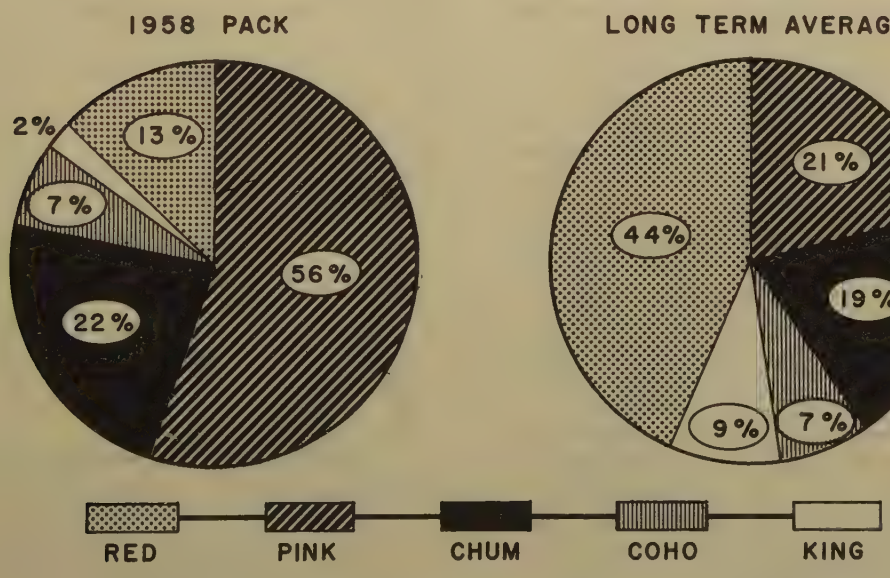

Figure 16.--Relationship of 1958 pack to long-term average, Cook Inlet.

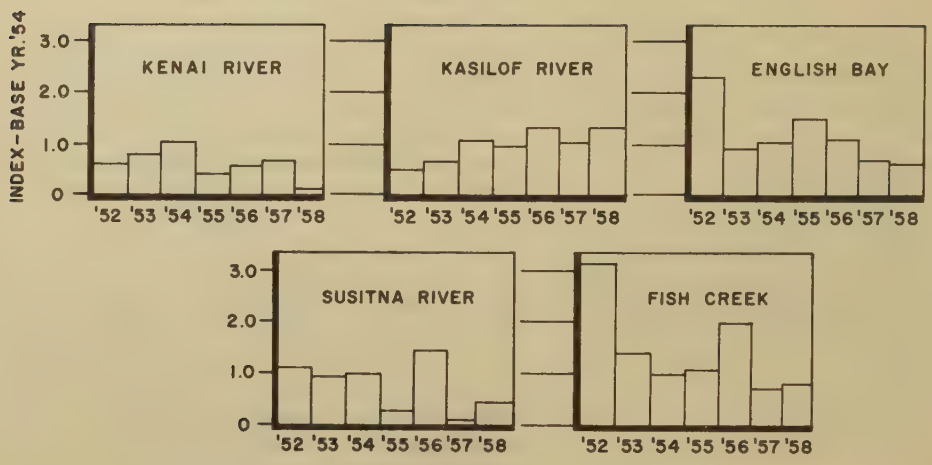

Figure 17.--Red salmon escapements, Cook Inlet.

of an unprecedentedly large run to the Susitna River in July and of a good showing in the Port Dick region on the ocean coast.

Even though fishing was permitted in the Cook Inlet area only two days per week during June and July, escapements were small. The red salmon escapements for Cook Inlet are shown in figure 17. Pink salmon runs have been too erratic in recent years to make a prediction for 1959, but as 1959 is an off-cycle year it will probably produce below 1958.

The problem of enumerating red salmon runs in the turbid streams that are typical of Cook Inlet is under study on the Kenai River. This research project, initiated in 1957, involved a program of test-fishing with two metal fyke traps that were located just offshore in the river on opposite banks about 9 miles upstream from the river mouth. The traps were fished throughout the red salmon run on the Kenai. The catches gave an indication of the relative day-to-day abundance of fish, and the total for the season was used to establish an index of escapement. In 1958 two traps were fished in the same locations and in an identical manner as in 1957 to give a comparison between the two years. The total season's catch of red salmon for each of the two years was almost the same, although the runs differed somewhat in timing. In 1958 they peaked about one week later than in 1957 (figure 18). Two additional traps were fished nearer midstream to determine if the rate of fishing were a function of the fishing site. The catches of these offshore traps were considerably smaller than those of the near-shore traps, demonstrating that the red salmon migrate primarily along the river banks.

Supported by a Bureau of Commercial Fisheries contract, the Fisheries Research Institute conducted tagging operations in the drift net fishery area from the M/V California Rose, a large seine vessel equipped for high seas tagging. Additional tagging was conducted from traps on both shores of Cook Inlet and on Kalgin Island. Fair numbers of red salmon (2,690) as well

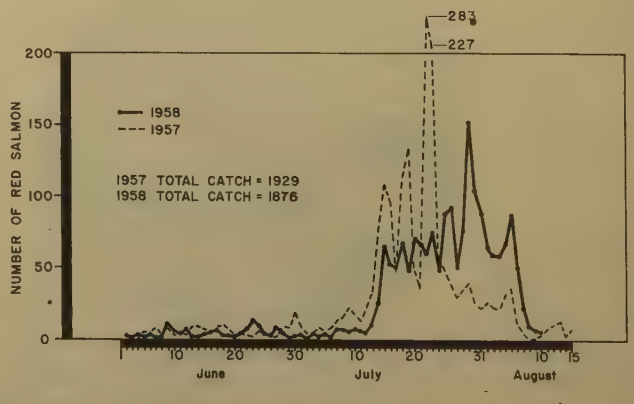

Figure 18.--Comparative test-fishing catches of red salmon on the Kenia River, 1957 and 1958.

as 1,648 pink salmon were tagged. In 1957 the overall recovery of tagged red salmon by commercial gear was 22.1 percent, somewhat lower than the average for experiments conducted in previous years. The recovery rate of tagged pink salmon in the fishery averaged 26.4 percent.

A new research project undertaken in Cook Inlet this year was a study of the king salmon runs in that area. A survey was made to learn the distribution and relative magnitude of the spawning runs and the size and age composition of the commercial catch, and to make observations of the personal-use and sport fisheries.

Streams along both the east and west sides of Cook Inlet were surveyed aerially and on foot, with the major effort being devoted to the Susitna River and its tributaries. The greatest number of king salmon seen in any stream was 221, but the usual order of magnitude was from 5 to 50. To reach their spawning grounds these salmon must pass through the commercial fishery, a personal-use saltwater fishery, a personal-use net fishery in some streams, and finally, an active sport fishery. It is possible that whole runs of king salmon have been destroyed or reduced to the point of near extinction by this extensive fishing pressure.

Kodiak

Kodiak's salmon trap fishery is concentrated in Alitak Bay and on the west sides of Kodiak and Afognak Islands in Shelikof Strait between Uyak and Malina Bays, where, from June to August, some of the major, red, pink, and chum salmon runs occur. More than 30 red salmon and 200 pink and chum salmon runs are harvested by the set gill net and seine fisheries that are distributed throughout the Kodiak area. A set gill net and seine fishery of minor proportions for coho and late chum salmon takes place during the fall season.

A vast increase in seine fishing effort since the early 1950's has been coincident with a sharp decline in the abundance of red and pink salmon. The chum salmon fishery has held relatively stable.

The total pack of 18,000 cases of red salmon for 1958 is less than one-fifth of the production average for the preceding decade. Reduced runs in the major producing systems, such as Karluk (figure 19), Red River, and Alitak, are largely responsible for the decline. However, some improvement in the Karluk run is expected in 1959.

Karluk Lake red salmon catch and escapement were both greater in 1958 than in 1956 or 1957, the catch being 190,097 and the escapement 273,523 fish. The distribution through the season of catch and escapement is shown in figure 20.

The pink salmon pack of 254,000 cases is well ahead of the parent cycle year (figure 21) but is barely two-thirds of the

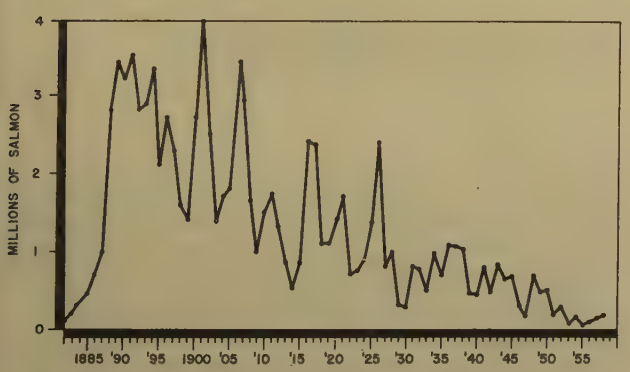

Figure 19.--Red salmon catch Karluk district.

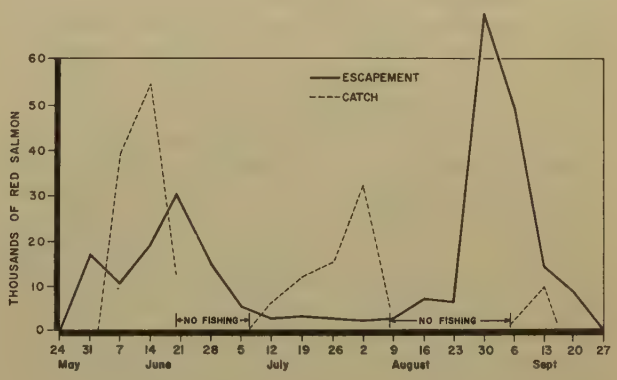

Figure 20.--Seasonal distribution of Karluk red salmon catch and escapement, 1958.

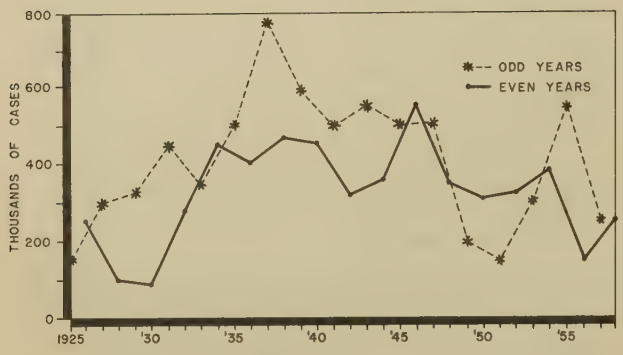

Figure 21.--Kodiak pink salmon pack.

previously normal even-year pack. The season, which traditionally ends on August 13, was closed on August 8 to improve escapement of the late runs.

Because of the relatively poor escapement in 1957, the outlook for strength in the pink salmon runs of 1959 is not encouraging. However, generally earlier spawning of the brood stock followed by an exceptionally mild winter could possibly result in a lower egg and fry mortality of this light seeding.

The chum salmon pack of 91,000 cases is well above the long-term average for this species. A general rise in the chum salmon catches of recent years possibly reflects increased fishing effort (figure 22) rather than increased abundance.

Research in 1957 and 1958 in the Kodiak area has indicated that the escapement into Karluk Lake utilizes different spawning areas as the season progresses. Examination of old records confirms this as a long-established phenomenon. In general, the red salmon of the spring escapement spawn in all streams tributary to Karluk Lake. The spawners that enter the lake in midseason go to the large rivers at the southern end of the lake, while in the fall separate waves of fish spawn in O'Malley River, Thumb River, the lake beaches, and upper Karluk River. Thus, at any given time during the season, the fishery captures fish destined predominantly for specific spawning grounds in the Karluk system. The spawning beds of this system fall naturally into several physical types, which are probably not equally productive. Determination of actual productivity of each stream type is one of the principal research objectives of the Karluk program.

Reports from previous years indicate red salmon fry that emerge from the gravels of upper Karluk River work their way upstream into Karluk Lake. This movement was verified in 1958 by the use of fry traps that were placed in the upper river near the outlet of the lake. Because the counting weir, which was used in former years, might interfere with the upstream migration of both fry and adults, the weir was not used in 1958. Instead, an estimate of the number of adult salmon entering the lake was made by use of counting towers.

Limnological investigations of the natural basic fertility of Karluk Lake were made in 1958. Comparison of fertility, as measured by the concentration of certain nutrients in 1958, with the fertility, as measured by the concentration of the same nutrients in 1926, showed only minor changes.

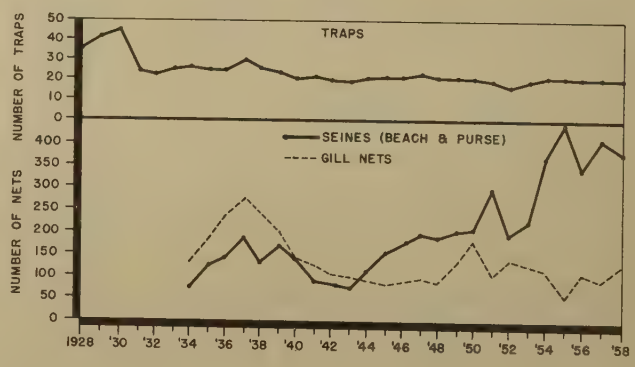

Figure 22.--Quantities of gear, Kodiak district.

Studies of the effects of removing predators and competitors from lakes to increase production of red salmon in freshwater were continued and expanded on Afognak Island. This work by the Alaska Department of Fish and Game is partially financed by the Fish and Wildlife Service. In 1958 Jennifer Lake was divided into an upper and a lower basin by means of a weir. All fish were removed from the upper part. Next year both basins will be stocked with red salmon

fry. The lower basin is to act as a control. To facilitate work on this expanded program, an addition to the existing laboratory was constructed this season.

Chignik

The Chignik area supports two types of salmon fisheries. Greatest interest is in the red salmon run into Chignik River itself. Though the fishery at one time produced catches in excess of one million fish annually, it has reached half that figure only once in the last decade (figure 23). Fishing is conducted in the lagoon at the mouth of the river by a concentration of beach seines. Traps that were formerly installed in the immediate vicinity have not been used for several years.

Pink and chum salmon-producing bays of the general type found along the Pacific Ocean coast form the basis for the remainder of the salmon fishery in the Chignik area. Like the adjoining fishery of the South

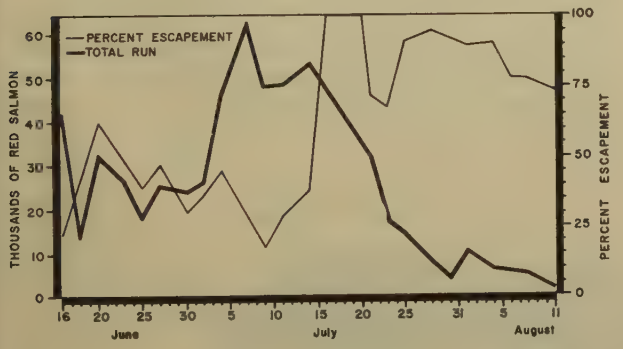

Figure 24.--Relation of Chignik red salmon escapement to total run, 1958.

Peninsula, which they resemble, the Chignik chum and pink salmon fisheries are in a reduced state.

The Chignik red salmon run for 1958 was below that of the past three years but was nearly as good as the parent cycle year of 1953. The escapement was 325,000 fish and the commercial catch 321,000. Fishery management of the Chignik red salmon followed the same principle used in 1957 in

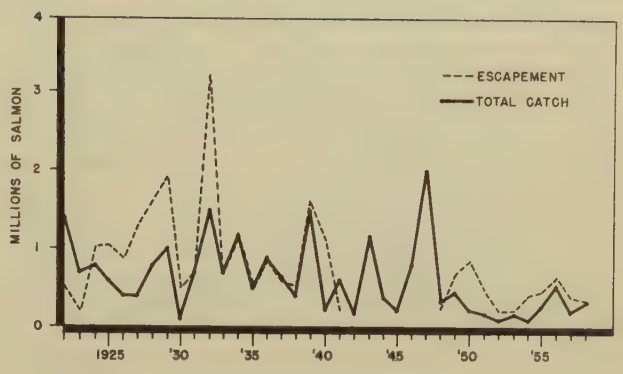

Figure 23.--Chignik red salmon catch and escapement.

attempting to attain representative escapements from each portion of the run. This is accomplished through the use of a large counting weir just upstream from tidal influence. During the first half of the fishery the escapement was somewhat less than the catch, but during the last half it was greater (figure 24). The lower percentage of escapements in the forepart of the season is believed to be due to the large number of boats that fished in the lagoon early in the season coincident with low tides during fishing hours. This restricted the fish to the river channels, making them more susceptible to capture. Two extra days of closure just before the peak of the run brought the escapement to within a few thousand of the catch to that date. This closure caused most of the boats and gear to seek fish outside of the lagoon, and many of them did not return. Thereafter, escapement exceeded catch until fishing ended on August 20.

With few exceptions escapement to the pink and chum streams in the Chignik area was very poor. The Aniakchak River, Hook Bay, and the Chignik River tributaries were the only exceptions, and even in these escapement was only fair.

Alaska Peninsula

In the waters off the western extremity of the Alaska mainland, which separates the Pacific Ocean from the Bering Sea, there are several salmon fisheries of varying characteristics. On the south side of

the Alaska Peninsula during June, traps and purse seines fish in the vicinity of False Pass where they intercept red salmon that are migrating to the Bering Sea and elsewhere. In July and early August the same gear takes pink salmon that are entering the many small streams tributary to the North Pacific Ocean along the full length of the Peninsula. In some years (e.g. 1954 and 1958) sizable schools of pink salmon occur on the north side of Unalaska Island in the Aleutian Chain. These also contribute to the pack of Peninsula canneries. A fall run of chum salmon is dominant in the catch in late August toward the westward between False Pass and Pavlof Bay. The fishery along the Peninsula and around the Shumagin Islands seems at certain times of the season to intercept not only local salmon but also runs destined for many other places. The average composition of the Peninsula pack, as compared with that of 1958, is shown in figure 25.

Both pink salmon cycles are at a low ebb of abundance on the South Peninsula, and severe regulatory measures are considered necessary to revive them. The 1957 pink salmon pack of 30,811 cases was an all-time low for the Peninsula.

On the north side of the Peninsula, from June to early August, sustained runs of red salmon enter the Bear and Sandy River systems east of Port Moller and Nelson Lagoon west of Port Moller. Several streams in Port Moller proper and in marshy Izembeck Bay produce a limited supply of chum salmon in late July and early August. Port Heiden, near the entrance to Bristol Bay, has a production potential in August of several thousand coho salmon. Fisheries along the Bering Sea Coast of the Peninsula are carried on largely by set and drift gill nets. Some purse seines are also used.

In 1958 red salmon again failed to appear off False Pass in any quantity, and consequently the Cape Lutke seine fleet catch was poor.

The low pink salmon pack, 71,074 cases, was substantially bolstered by the unusual catch of 600,000 fish in the Aleutians. This species appeared erratically throughout the South Peninsula and was briefly in fair abundance in the False Pass and Sanak Island areas, which normally are not noted for pink salmon. Showings were poor in the usually populous southeastern and southcentral districts and were only fair in the Shumagin traps. Aerial surveys indicated pink salmon escapements were below the level of the 1956 cycle.

Prospects for a satisfactory pink salmon run in 1959 appear unlikely in view of both the poor escapements and the drought

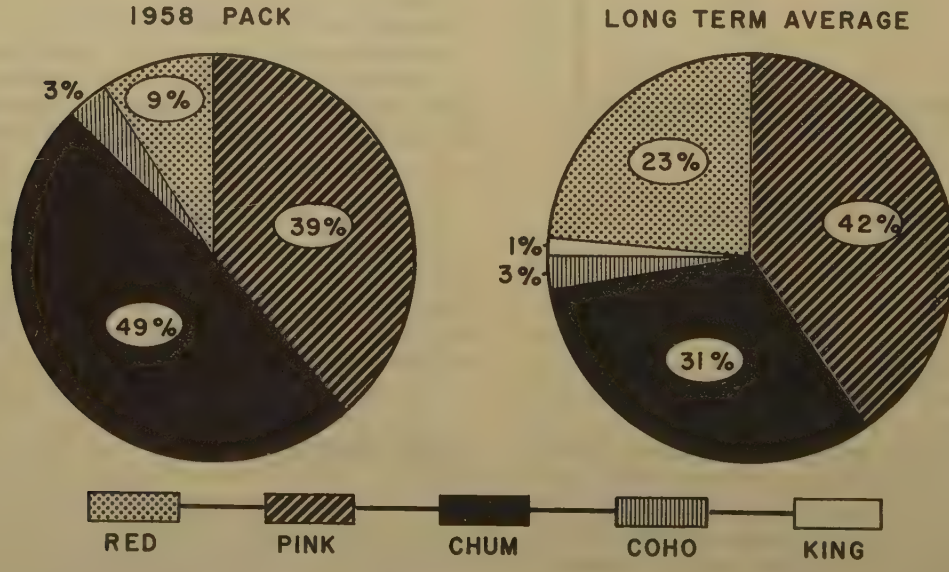

Figure 25.--Relationship of 1958 pack to long-term average, Alaska Peninsula.

conditions that prevailed through early August in 1957.

The chum salmon run was light throughout the season. Fall chum salmon abundance dropped off rapidly after three days of concentrated fishing effort following the August 18 opening in the southwestern district. Coho salmon appeared earlier than usual in the fishery and were more numerous in the Shumagin trap catches than for many years. The seasonal composition of the South Peninsula pack is shown in figure 26.

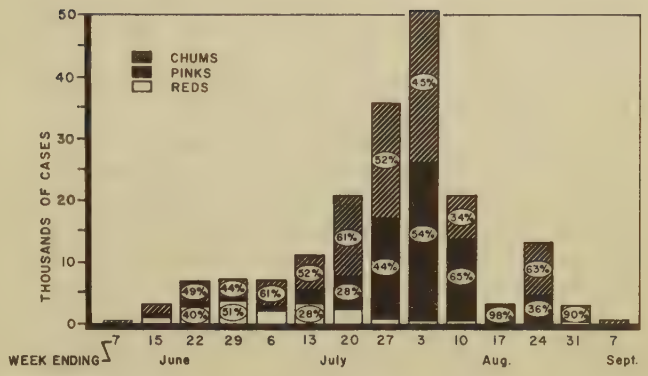

Figure 26.--Seasonal composition of South Peninsula salmon packs, 1958.

The Bear River and Sandy River red salmon runs were quite opposite in character. In the former, a steady seasonal escapement was maintained despite a heavy concentration of gear and reached an estimated 200,000, compared with a total drift and set net catch of approximately 305,000 red salmon. The Sandy River red salmon escapement was very poor in comparison with past surveys. Purse seine catches between Bear River and Cape Seniavin were low--approximately 85,000 red salmon. The weekly allowance of four 12-hour fishing days in the Bear River district was extended after a substantial decrease in gear occurred, to six 12-hour days beginning August 8. Severe weather hampered the remnant fleet however, and catches were negligible.

An experimental mild-cure fishery for early king salmon at Nelson Lagoon, Port Moller, and Bear River produced a surprising 10,000 fish from a small gill net fleet. A late August fishery in Nelson Lagoon yielded a good supply of coho salmon.

Research biologists conducted a pink salmon tagging program in the Alaska Peninsula area. The objectives of the 1958 experiments were to determine the origin of the pink salmon in the catch and the rate of movement of the fish through the fishery. Another purpose was to determine if the easterly migration trend observed during the 1957 tagging program is common to pink salmon along the entire south coast of the area and if this movement is persistent throughout the season.

Figure 27.--Pink salmon tag recoveries, 1958.

A total of 7,064 pink salmon was tagged between June 23 and August 3 from various locations between False Pass and Ivanof Bay, a 175-mile stretch of coast along the western reaches of the south Alaska Peninsula. In addition to pink salmon, 968 chum salmon were tagged at intervals throughout the season. The tagging experiments were conducted from traps and seines and were carried out during open and closed periods.

Tag recoveries of pink salmon have been made from such widely separated points as Norton Sound, the Yukon River, Kuskokwim Bay, Nushagak, Unalaska, Chignik, and Kodiak (figure 27). Analyses will be made later to determine if these various migration

patterns can be differentiated on the basis of time or area of tagging.

The sea lion studies being conducted by the Fisheries Research Institute, under support of another Bureau of Commercial Fisheries contract, are now in their third year. In 1956 and 1957 census techniques were developed that indicated there were upwards of 78,000 sea lions on the major rookeries in the Gulf of Alaska. The 1958 research was concerned with developing methods of controlling the numbers of sea lions. A scientific party, working in the Shumagin Islands in May of this year, made continuous observations on the life history and feeding habits of sea lions in a rookery. Some killing experiments were conducted. From information gained during this season's work it appears impractical to haul or move the carcasses to a collecting station on the rookery. Instead, the animals must be shot near the water where a line can be attached from the receiving boat to the carcass prior to rolling the dead animal into the surf. Thus secured and in the water, the carcasses may be easily towed to a ship or scow.

Bristol Bay

Although the Bristol Bay fishery has declined to a low state since the late 1930's when several packs exceeded one and one-half million cases, it is still popularly regarded as one of the world's foremost producers of red salmon (figure 28). Its major river systems and huge lakes provide ideal spawning and nursery environment for this most favored canning species. Gill nets that are drifted on tidal currents from small, specially designed power boats are the principal gear of the fishery, although a few set nets are aggregated along the shores. Fishing activity is confined by regulation to localized areas off the river mouths. The red salmon runs normally extend over a 1-month period that commences in late June.

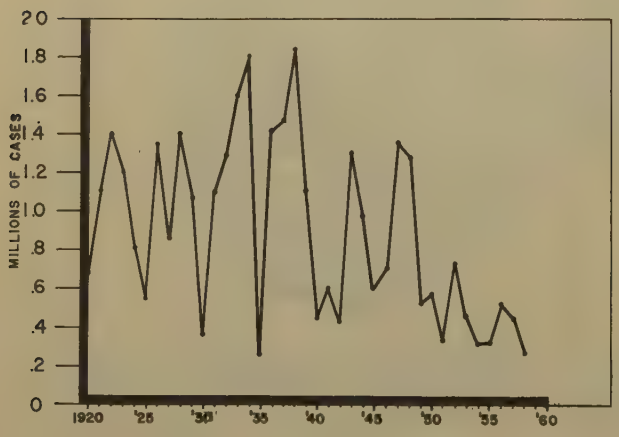

Figure 28. --Bristol Bay red salmon production.

Lesser runs of king salmon, principally in the Nushagak district, contribute to the Bristol Bay catch as do pink salmon runs, which occur in unpredictable volume in even years. In addition, chum and coho salmon make minor contributions to the Bristol Bay salmon production.

In order to achieve red salmon escapement necessary to conserve the runs, the number of fishing days per week during the season are regulated by the amount of gear that is fished. Management of the fisheries in the major river districts is based on daily reports of escapement and catch per unit of effort (the average daily catch of a 2-man boat calculated each fishing period). All other combinations of gear are equated to this unit by applying computed gear equivalents. During the 1958 season, the amount of gear being fished was such that it permitted only about two days fishing per week.

Escapements were enumerated from counting towers on the Ugashik, Egegik, Naknek, Igushik, and Branch Rivers by Bureau personnel, and on the Wood and Kvichak Rivers by biologists of the Fisheries Research Institute.

Preliminary red salmon catch and escapement estimates for four Bristol Bay regulatory areas in 1958 are as follows:

	Catch	Escapement
Nushagak	1,091,000	1,105,000
Naknek-Kvichak	923,000	878,000
Egegik	501,000	246,000
Ugashik	434,000	295,000
Total	2,949,000	2,524,000

In addition, a catch of about 36,000 red salmon was taken from the Togiak

district. Adverse weather conditions made it difficult to estimate the escapement in that area; however, a late survey indicated an escapement of about 70,000 fish. The catch, effort, and escapement estimates for the major river systems are shown in figure 29.

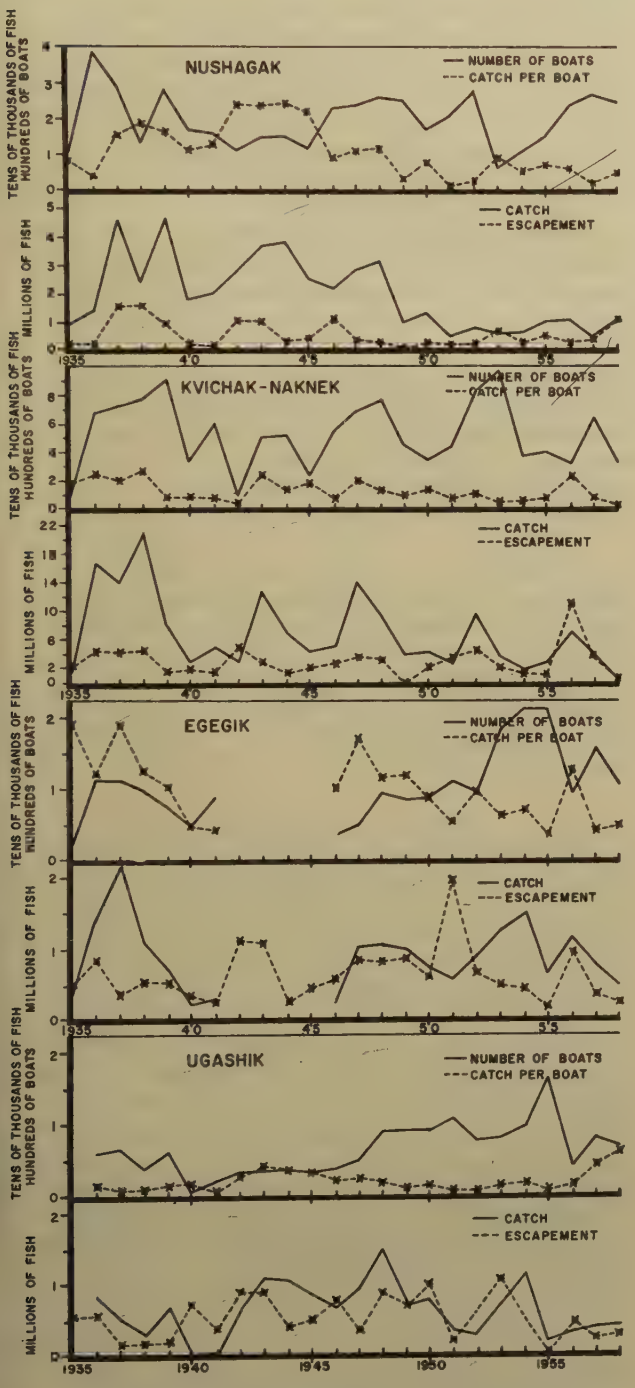

Figure 29.--Catch, effort, and escapement, Bristol Bay.

The estimated 1958 total run of about five and one-half million red salmon was below expectations, and the overall outlook indicates no improvement in 1959.

It is expected that the total run to the Naknek-Kvichak district will be between one and three million fish. A study of past escapement figures and of information that is available on 1956 and 1957 smolt outmigrations for the Egegik and Ugashik systems points to runs of fewer than one million red salmon to each of these districts.

For the Nushagak system there are more data on which to base forecasts of returning runs. Analyses of these data are not yet complete. General escapement figures alone, however, indicate that the red salmon run to the Nushagak River in 1959 should be at least as good as the run in 1958.

This year's Nushagak king salmon catch of 85,219 fish was the highest since 1929 (figure 30). To offset rising effort and maintain adequate escapement, fishing time was curtailed to four days a week during the Nushagak king salmon season. Also, gill net depth was standardized at 28 meshes to prevent use of overly deep nets.

An unexpected bonus on the Nushagak fishery was the abundance of pink salmon during and after the latter part of the red salmon season. Approximately 60,000 cases of pink salmon were packed, and at least 800,000 fish spawned upstream in the Nushagak and Nuyakuk Rivers. Because of the selectivity of gill nets, the catch consisted predominantly of large males, which

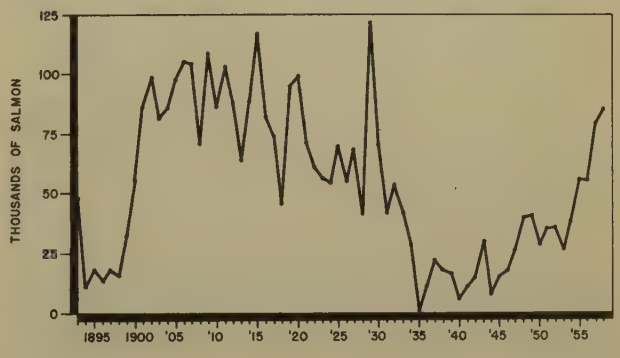

Figure 30.--Nushagak king salmon catch.

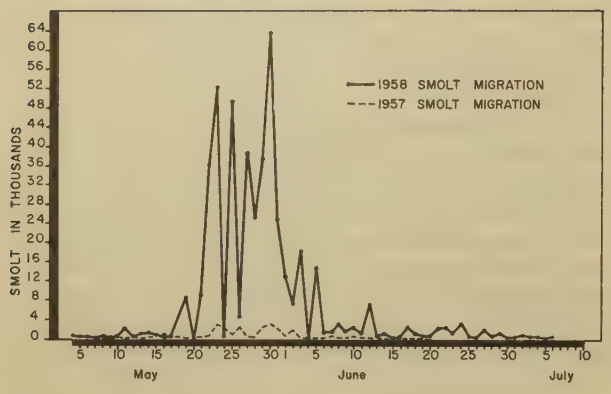

Figure 31.--Comparative smolt migration on the Ugashik River.

average 16 fish per case. Preliminary stream checks indicate that about 75 percent of the spawners were female. Canneries report that the quality of the pink salmon was exceptionally good.

Research activity in Bristol Bay was carried out by both the Bureau of Commercial Fisheries and the Fisheries Research Institute. The Institute continued with its industry-sponsored work on the Wood and Nushagak Rivers. Principal emphasis in these studies was placed on enumerating upstream migrants, determining indices of smolt abundance, and studying the early life history of the red salmon in the lakes.

Under support of a Bureau of Commercial Fisheries contract, red salmon research activities on the Kvichak River were continued by the Fisheries Research Institute for the fourth consecutive year. Seaward smolt migration was determined with the aid of fyke nets, and adult escapement counts were made with the use of towers. Biologists on the Kvichak noted an outmigration far in excess of any recorded previously. Special emphasis was placed on learning the relationship between timing of the adult salmon runs and the distribution of fish on the spawning grounds.

The Bureau continued its several research programs in the Bristol Bay area. Efforts were directed toward estimating the extent of the night migration of salmon, enumerating the smolts, and sampling to determine the age composition of the catch. Knowledge of each of these factors would be of material assistance in the management of this fishery.

Satisfactory night counts, obtained by illuminating the migration paths directly in front of the counting towers, produced gratifying results. The lighting was done with 6- or 24-volt spotlights arranged so that the beam of light was angled downstream from the bank. It had been assumed, from experience on other waters, that red salmon migrations at night were negligible, but in these studies it was found the migration peaked at night on the Igashik River.

The smolt outmigrations in the Naknek, Ugashik, and Kvichak systems were much larger than any recorded for these rivers over the past several years. In the Naknek River there was an indication of an outmigration of approximately 10 million smolts. This compares with 6 million in 1956 and 3 million in 1957. On the Ugashik River, evidence pointed to an outmigration some 20 times larger than that recorded in 1957 (figure 31).

The Kvichak smolt index, which is determined by the Fisheries Research Institute, is considerably higher for the 1958 outmigration than for the three previous years. In 1955 the index was 203,000; in 1956, 50,000; in 1957, 23,000; and this year (1958), 1,913,000. Most of the fish were 2-year-olds.

The Egegik outmigration work was interrupted because of budgetary restrictions. Scale analysis showed that this year's smolts were primarily the progeny of the 1956 brood year--a year noted for large escapements in some of the major tributaries of the Bay.

The enumeration of red salmon fingerlings was accomplished with the use of fyke nets. Preliminary tests with electronic counting devices utilized in the cod end of the net showed considerable promise, and if such units can be satisfactorily developed to the point where they can be used on a wide scale, the enumeration of fingerlings will be greatly facilitated.

Development of methods and sampling procedures to obtain age and length data of adult red salmon in the returning runs was continued for the second consecutive

year. This work is being carried out in cooperation with the Fisheries Research Institute. Extensive scale samples and length data were collected from fish taken from the Kvichak, Naknek, Egegik, and Ugashik River systems (figure 32). Samples were obtained from two sources, the escapement and the commercial catch. In the latter, the fish were taken directly from conveyor belts at the canneries in the various districts, while the escapement sampling was accomplished by beach seining.

Analyses indicated that the age composition of red salmon differed significantly in each of the Bristol Bay River systems studied. The tabulation following, which is based on preliminary data, shows the approximate contribution of each brood year to the total run.

Brood year	River			
	Kvichak	Naknek	Egegik	Ugashik
1952	45%	29%	39%	10%
1953	34%	48%	58%	86%
1954	16%	22%	2%	4%
Total-other brood years	5%	1%	1%	--

Figure 32.--Taking scale samples on Ugashik River.

Several projects involving basic research on environmental factors that affect survival of red salmon were continued at the Brooks Lake research station (Naknek River system).

A reliable technique, using radioactive tracers, was developed to determine factors limiting productivity of natural waters. Phytoplankton production varied greatly from one lake to another, and it was indicated that magnesium may be a limiting factor in Brooks Lake. The chemical effects on lake water of decomposing salmon carcasses and of volcanic ash and pumice were studied in 1958. The findings are undergoing analyses.

Food studies, based on two summer's extensive experimental gill netting in Brooks Lake, indicate that predation in this lake is of minor significance in the freshwater life of red salmon and also that most fish, including red salmon, prefer insects for food.

Preliminary studies were begun to develop a workable photographic technique to enumerate outmigrant red salmon in Brooks River.

Yukon River and Arctic Area

North of Bristol Bay the only commercial fishing of significance is a gill net fishery for king salmon, which is conducted during June on the lower Yukon River. A quota of 65,000 fish is the maximum catch allowed by regulation and is shared by several small canneries and salteries. By act of Congress, no other species of salmon may be commercialized on the Yukon River, even though large runs of chum and coho salmon do occur. The aboriginal peoples of the area depend upon salmon and other fish as a fundamental source of food for themselves and their dog teams. It is the policy of the Federal Government to grant such subsistence needs the highest priority in the utilization of salmon runs along the northern and western coasts and also in the interior. It is for this reason that the commercial fishery on the lower Yukon is limited to a relatively small quota of king salmon.

Not much is known about the other fisheries of the far north because of their remoteness. The Kuskokwim River has significant runs of all salmon except pink, while Unalakleet River sporadically produces pink salmon in abundance. Chum salmon occur in most of the northern streams.

A study has begun on the native personal-use fisheries of the Yukon and Arctic that will provide considerably more knowledge than is now available on the utilization of salmon, as well as other species.

REVIEW OF THE MARINE FISHERIES

Herring

The herring catch in Alaska is utilized principally in a reduction industry, the products of which are oil and meal. In addition, a bait fishery accounts for a small proportion of the total catch. In the early period of the herring fishery, much of the catch was salted and/or pickled, but at the end of the First World War (1918) the market for Alaska herring as food products declined, and the only pickled fish produced at the present time are for personal use.

After an early but slow start, the production of herring oil and meal reached considerable proportions, and in 1937 more than 138,000 tons of fish were taken for reduction purposes. As in other herring fisheries of the world, the Alaska catch is often dependent on the presence of one or two strong broods (year classes), and further, as in other herring fisheries, environmental conditions can apparently produce profound effects on the size of the stocks. For these reasons, and also possibly because of overfishing, the herring catch in Alaska declined to alarming levels in 1942. By 1946, however, the catch again reached a high level--only to drop to an all-time low in 1949. Such fluctuations in production hamper the development and expansion of the industry. In recent years the catch of herring in Southeastern Alaska has been limited by quota.

Three areas in Alaska are fished for herring--the inshore waters of Southeastern Alaska, Prince William Sound (including Resurrection Bay), and around Kodiak Island. The contemporary reduction fishery takes

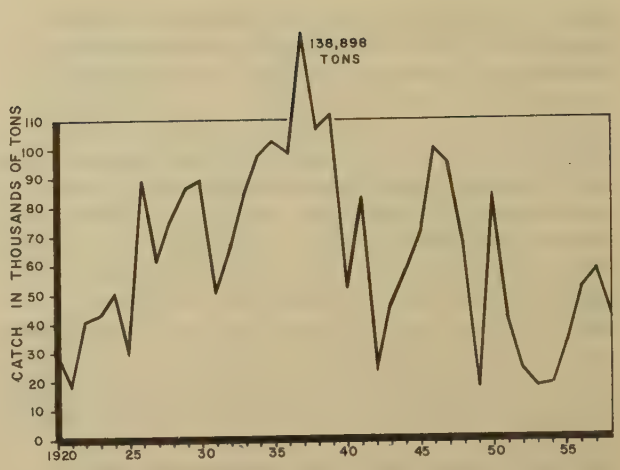

Figure 33.--Total Alaska herring catch.

place in summer using purse seines. The bait fishery, which utilizes about 3,000 tons of herring annually, employs pounds and traps and a small number of gill nets. The bait herring are marketed locally in both the fresh and frozen state.

In 1958 the reduction fishery failed to maintain its upward trend in production, and the total catch for Alaska was 41,788 tons (figure 33). Although the catch in Southeastern Alaska was excellent (36,185 tons) and above the long-term average for the past quarter century, Prince William Sound and the Kodiak district produced the poorest catches on record (3,892 and 1,711 tons respectively).

As in the two preceding years, the fishery was largely supported by the survival of the 1953 spawning. These age-group V fish accounted for more than 80 percent of the catches in Southeastern Alaska and the Kodiak area. In Prince William Sound the availability of age-group V was low, and 47 percent of the catch was from the I and II year age groups (figure 34), which are not ordinarily utilized commercially.

Twenty-two boats participated in this year's fishery, 14 in Southeastern Alaska and 4 each in Kodiak and Prince William Sound. The catch per boat-ton day remained high in Southeastern Alaska, which had a seasonal average of 1,100 pounds per unit of effort (figure 35). This is slightly less than the average for 1957, although it is 350 pounds more than the Southeastern Alaska

average for the past 27 years. Very low catches per unit of effort were evident in Prince William Sound (540 pounds) and in Kodiak (380 pounds).

Research efforts forming an integral part of the herring program are twofold in nature. Several short-term studies are designed to guide and assist in the immediate management of the fishery, whereas the long-term projects seek to isolate the underlying causal factors that determine abundance and fluctuation of herring stocks.

Annual surveys of the extent of herring spawning are generally indicative of the abundance of adult herring that contribute to the spawning. It is supposed that these adults are largely available to the ensuing summer fishery. Herring spawning in 1958 utilized 134 miles of beach in Southeastern Alaska (figure 36). This compares favorably with the 132 miles recorded in 1957 and the 148 miles in 1956. Spawning occurred 7 to 10 days earlier than usual in all areas of Alaska this year, a fact which may possibly be attributed to the recent general increase in ocean temperatures.

Collection of age composition, length, and weight data, as well as related statistics, must continue each year the herring fishery operates in order to accurately assess the condition of the stocks. In 1958 these data were transcribed to machine punch cards in the field through development of a portable IBM card punch. Efforts are continuing to increase the efficiency of this annual program.

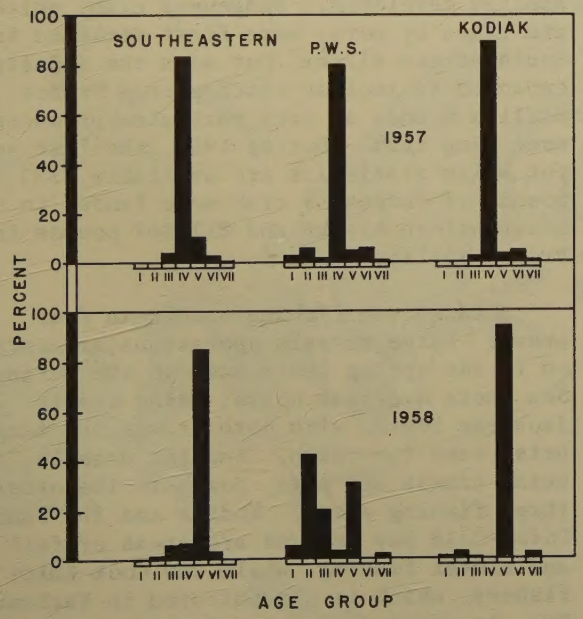

Figure 34.--Age-group percentages, Alaska herring.

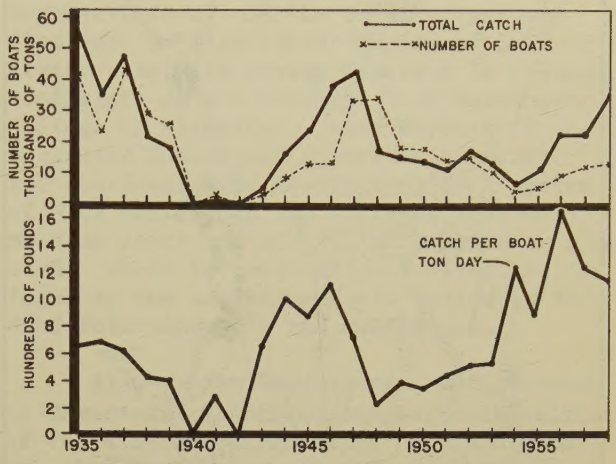

Figure 35.--Southeastern Alaska herring fishery catch, boats, and catch per unit of effort.

Studies are being conducted on the interrelationship of herring and salmon, particularly the extent that troll-caught salmon are dependent on herring. Preliminary data indicate that in the inside waters of Southeastern Alaska herring occurred in 40 percent of the king and 17 percent of the coho salmon stomachs that were collected throughout the summer months. Smelt-like fishes and other forms constituted the remaining food. The extent of utilization of herring as food varied greatly with the geographical area.

The greatest single need for the successful management of the herring fishery is knowledge of the number and extent of individual herring stocks. Serological (blood) analyses and mathematical studies of bone structure show great promise as methods of identifying discrete herring races, and much research effort is being devoted to this work.

To determine migration and the degree to which herring stocks mix, a herring

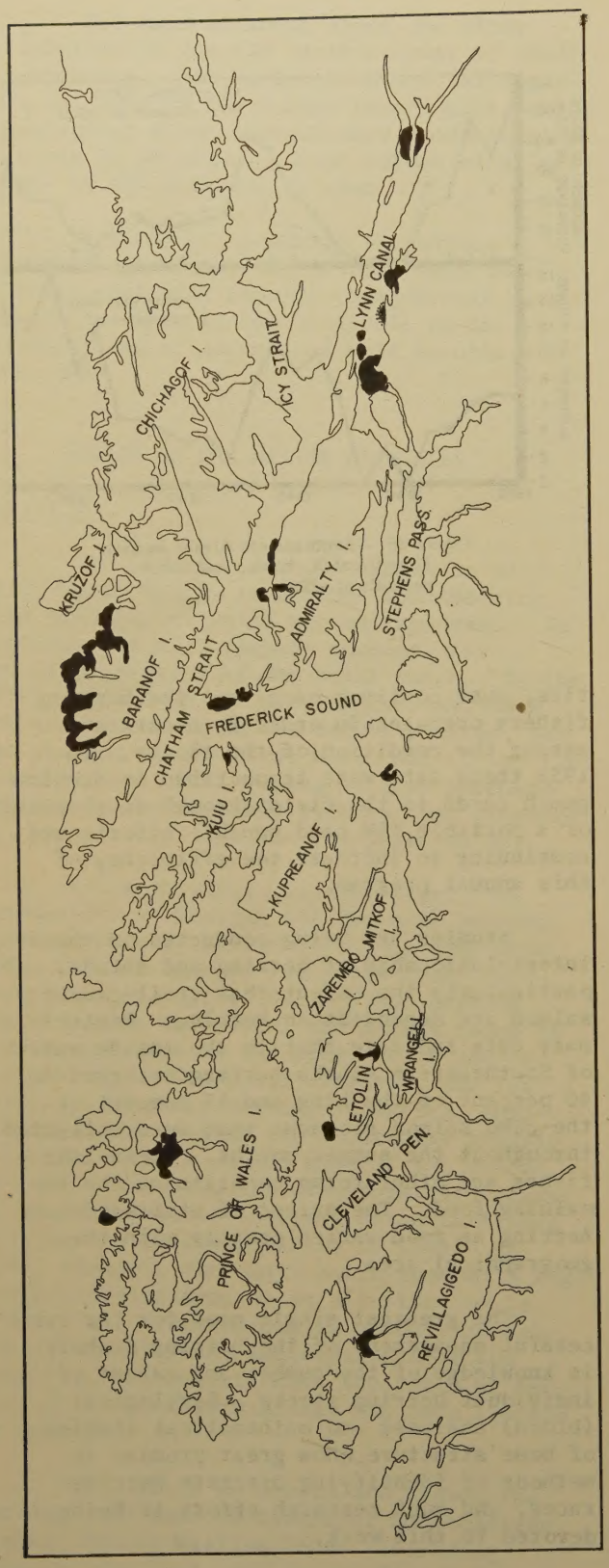

Figure 36.--Herring spawning areas in Southeastern Alaska, 1958.

tagging program is needed. Because of their size and of the method used in their processing, an external tag cannot be detected on herring, and it is necessary to develop an internal tag. During 1958 exploratory studies on the use of an internal radioactive magnetic tag were completed. Field testing of a device to detect and eject tagged herring from the processing plant's production line was successful. The magnetic feature of the tag alleviates any possibility of the radioactive substance entering the processing plant's finished product. It is planned to complete the necessary procedural matters in compliance with Atomic Energy Commission regulations in time to inaugurate a herring tagging program by spring of next year.

Crab

King, dungeness and tanner crab have all been utilized commercially in Alaska. At the present time, partly because of technological problems, there is no fishery for the abundant tanner crab. Although king and dungeness crab each contribute to the total Alaska crab pack, the former is by far the dominant species landed. The crab industry had its origin in 1909 in Southeastern Alaska when a market developed for fresh dungeness crab. However, it was not until 1921 that a canning industry for this species developed. Dungeness crab, which are taken by pots, were first marketed in Southeastern Alaska, but soon the industry expanded to include catches from Prince William Sound, an area that also produces some king crab. During 1957, the last year for which statistics are available, 333,974 pounds of dungeness crab were landed in Southeastern Alaska and 217,867 pounds in Prince William Sound.

King crab fishing occurs in four areas. Large vessels operations are carried on in the spring and summer in the Bering Sea where American boats, using trawls, and Japanese boats, with both trawls and tangle nets, take the catch. Smaller vessels, using trawls and pots, dominate the other three fishing areas. Kodiak and the Sand Point-Cold Bay regions are areas of fall and winter fishing, while the Cook Inlet fishery, which is concentrated in Kachemak Bay, is carried on primarily in the summer months.

As shown in the following tabulation, king crab landings in 1957 showed increases over those of previous years, except for the Bering Sea and Cook Inlet areas.

Year	Bering Sea	Sand Point-Cold Bay Shumagin Islands	Kodiak	Cook Inlet
1954	2,514,243	316,660	4,764,315	1,271,825
1955	2,211,800	1,640,688	2,394,611	1,972,177
1956	1,896,227	2,043,967	4,126,793	2,072,679
1957	588,434	6,684,422	5,177,608	620,858

Active research programs are proceeding in each of the king crab fishing regions. In the Bering Sea, research is conducted under the auspices of the International North Pacific Fisheries Commission, and south of this area investigations are conducted or supported by the Alaska Region of the Bureau of Commercial Fisheries. To determine the extent of interchange of king crabs between the Bering Sea and the Gulf of Alaska, biologists of the international fisheries group tagged 1,999 crab in the summer of 1957 south of the Alaska Peninsula near the Shumagin Islands. To date 93 tags have been recovered, primarily from the fall and winter fishery. The seasonal movement shown by this tagging (figure 37) is to inshore waters. On the basis of present findings, no significant mixing of Gulf of Alaska crab with Bering Sea crab is evident. Biologists of the University of Washington College of Fisheries, under support of a Bureau of Commercial Fisheries contract, are continuing the development of a system of data collection and analyses that will provide catch and effort information on king crab. Their techniques involve the use of logbooks and are being field tested in the Sand Point-Shumagin and Kodiak areas.

Also in the Kodiak area, with Bureau of Commercial Fisheries support, biologists of the Alaska Department of Fish and Game are studying the growth and movement of king crab. This research is carried out principally in Chiniak Bay.

The Bureau's crab research laboratory in Kachemak Bay serves as a base of operations for both the University of Southern California contractor and the Bureau studies of the Cook Inlet fishery. The University of Southern California group is conducting a tagging program to ascertain population movement and growth of king crab in Kachemak Bay and lower Cook Inlet. Results to date have shed considerable light on the biology

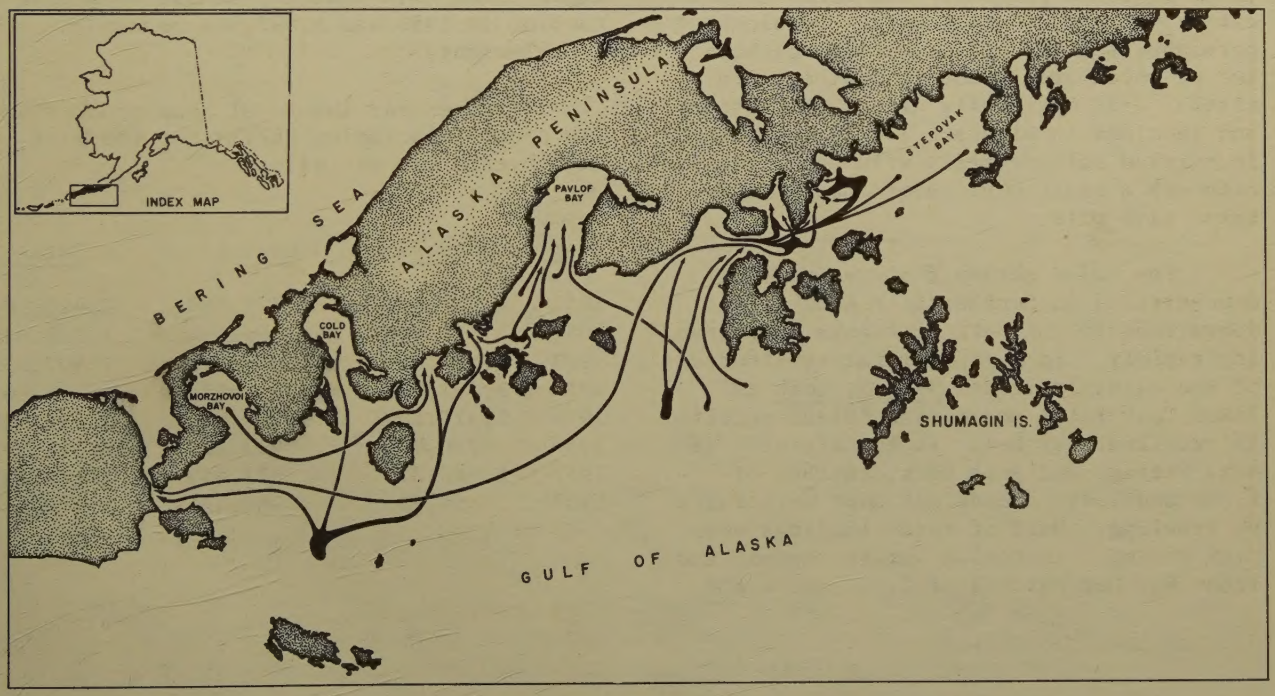

Figure 37.--King crab tag recoveries.

of crab in the young stages. Preliminary tag returns indicate that there is little tendency for Kachemak Bay crab to move out into Cook Inlet proper. Research biologists of the Bureau are studying the crab fishery through collection of size composition, catch, effort, and related data.

Shrimp

Commercial fishing for shrimp began in 1915 in Southeastern Alaska, and although expansion of the industry was slow, four plants were in existence by 1921. Production of shrimp rose steadily and in 1925 reached 520,000 pounds. In the years that followed, some fluctuations in landings took place, owing to the depression and World War II, but a production high was again reached in the 1948 to 1950 period. Shrimp production in Southeastern Alaska in 1957, the last year for which statistics are available, was 2,350,449 pounds. This compares favorably with the good catch of 3,031,598 pounds in 1956 and is well above the 1,777,122 pounds taken in 1955.

With the general decline in abundance of Gulf of Mexico shrimp, it is expected that the demand for the Alaskan product will greatly increase and production will climb to a new plateau. The recent application (largely through Market Development personnel activities) of machine pickers, two of which are in use in Southeastern Alaska, will materially affect production and landings in Alaska. The shrimp fishing is carried out primarily with beam trawls, although a small portion of the catch is taken with pots.

The major shrimp fishery is still concentrated in Southeastern Alaska, but operations in the Gulf of Alaska are expanding rapidly. In 1958 exploratory efforts of the Bureau's vessel John N. Cobb in lower Cook Inlet and Kodiak Island resulted in excellent catches. In the vicinity of Nuka Passage and Port Dick, catches of 1,560 and 1,440 pounds per hour were taken by trawling. Half of these landings were pink shrimp. In Kodiak waters, Marmot and Izhut Bay had catches of 2,600 and 2,800 pounds per hour, while Alitak produced catches of about 1,800 pounds per hour. These explorations have caused much interest both in and outside of Alaska, and it is expected that during the 1959 season new commercial shrimp operations will take place in the Gulf of Alaska.

Clam

Alaska shellfish resources include butter, cockle, and razor clam, as well as several other lesser used forms. In addition to a widespread personal-use fishery, commercial digging for razor clams has been carried out on a large scale near Cordova and on Kodiak Island since 1916. The total clam harvest is about two million pounds annually.

Butter clams are taken primarily in Southeastern Alaska where production was formerly at a good level. Unfortunately this species occasionally absorbs toxins and production is currently retarded.

In 1958 the pack was below average. Negotiations between Cordova diggers and processors broke down, and a strike ensued prior to the season. As a result, Cordova produced only 6 percent of the pack of razor clams this season. Alaska clam production in 1958 was 1,023,934 pounds (shellweight).

Figures for the total clam production (in pounds, including shell) for the past eight years are as follows:

Year	Cordova	Kodiak	Total
1951	1,535,119	955,582	2,490,701
1952	1,272,845	no operations	1,272,845
1953	1,507,857	no operations	1,507,857
1954	1,275,900	no operations	1,257,900
1955	1,377,109	1,360,841	2,737,950
1956	770,970	923,227	1,694,197
1957	1,986,087	903,049	2,889,136
1958	59,353	964,581	1,023,934

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